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(54) A CRANK ASSEMBLY FOR A CYCLE

(57) The invention provides a crank assembly for a cycle, the assembly comprising a crank shaft 1, two crank arms 2, (3) fixed one to each end of the crank shaft, two retaining members 4 screw-threadedly engaged with engagement portions at the ends of the crank shaft, so holding the crank arms in position on the shaft, and two locking members 5 engaged with the crank arms and restricting axial movement of the retaining members relative to the crank arms.

Fig. 3

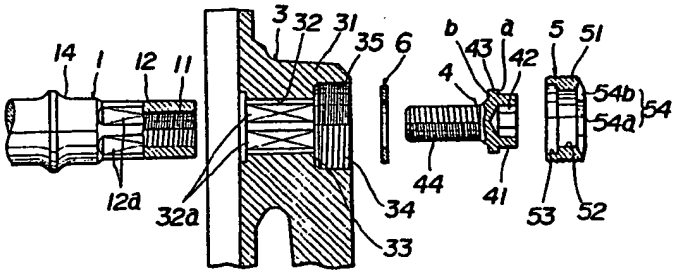

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Fig. 1

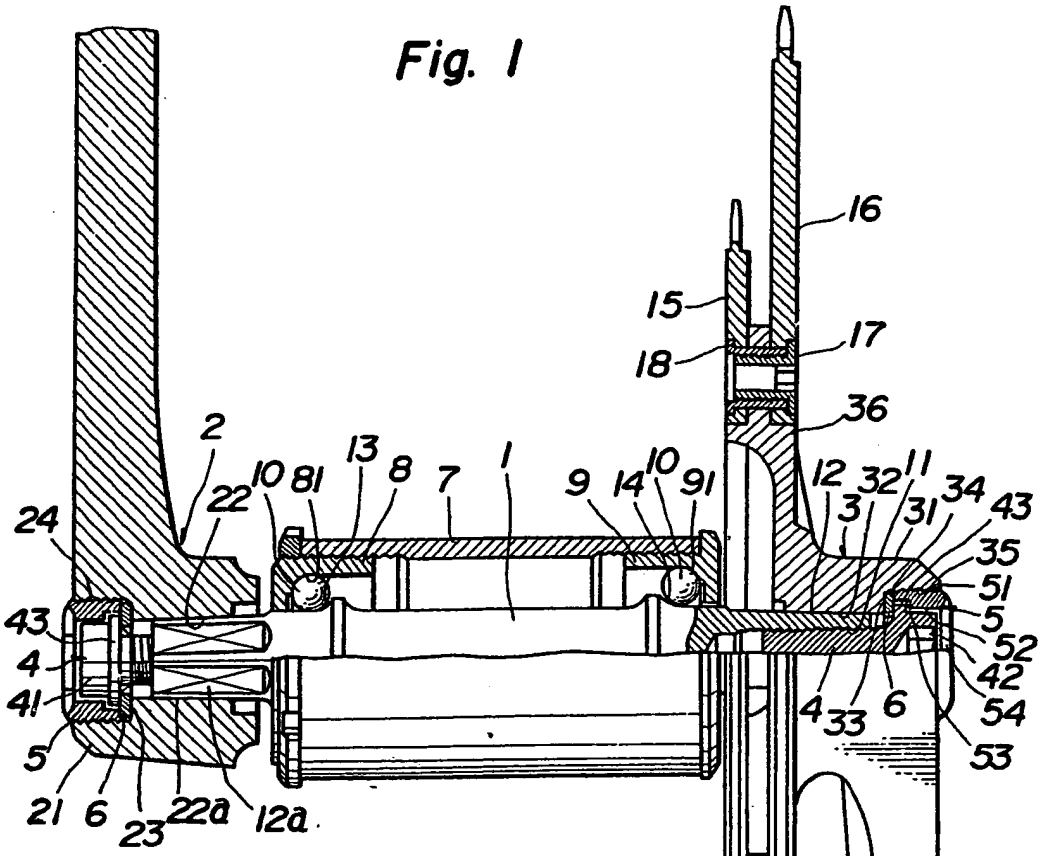


Fig. 2

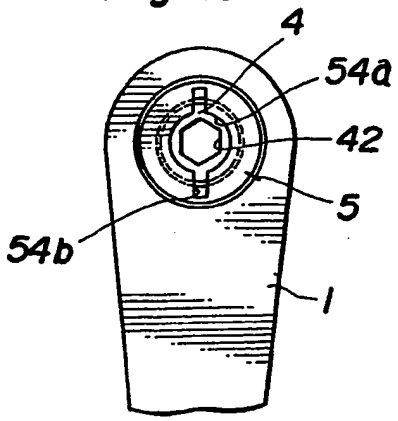
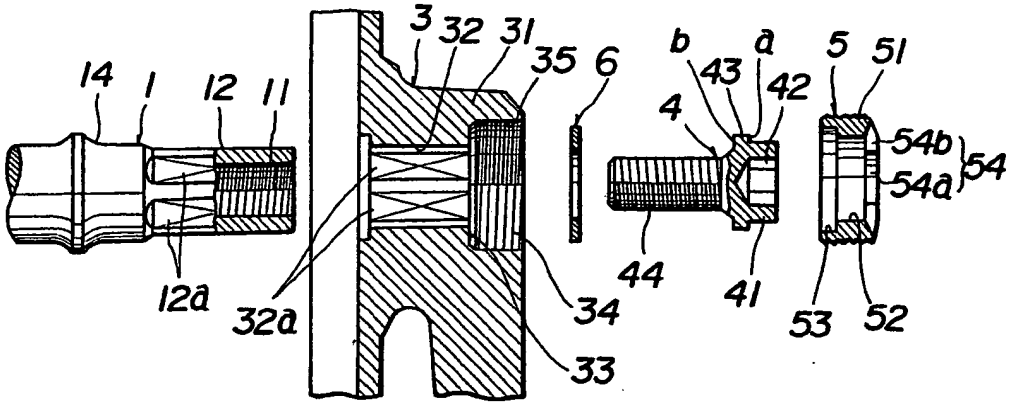


Fig. 3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3
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6
b
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12a
32a
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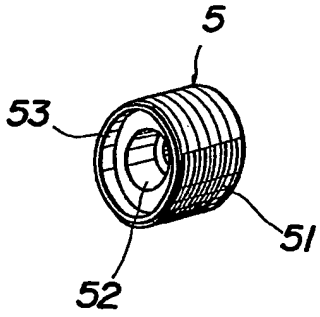
33
44
41
53
52

Fig. 4


5
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51
52

2002089

Fig. 5

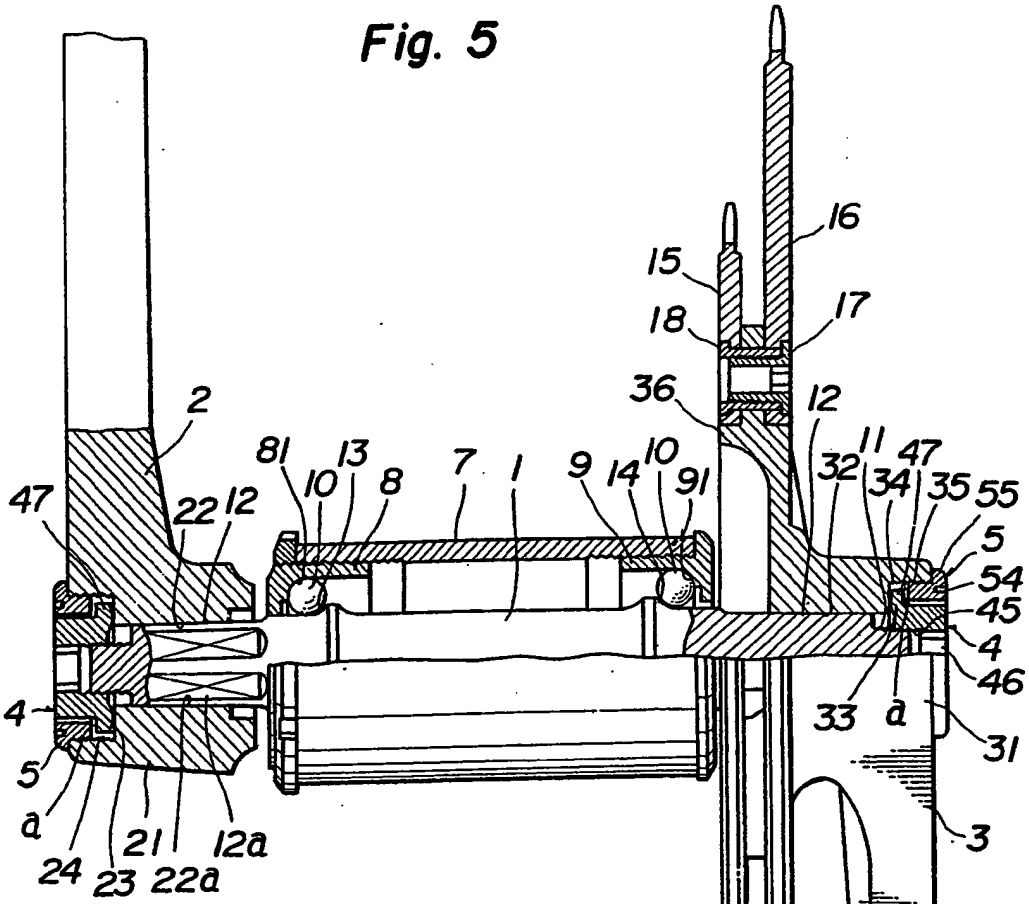


Fig. 6

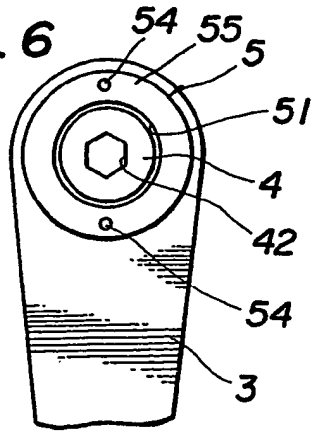
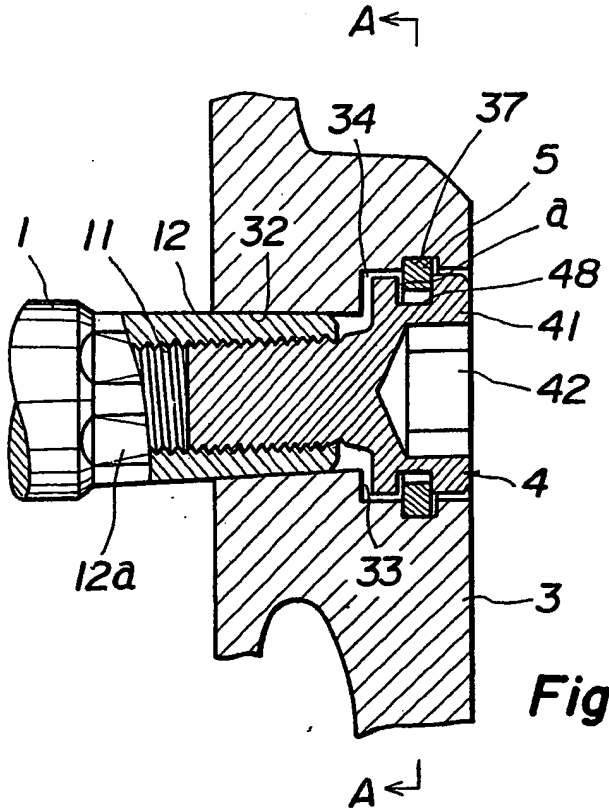


Fig. 7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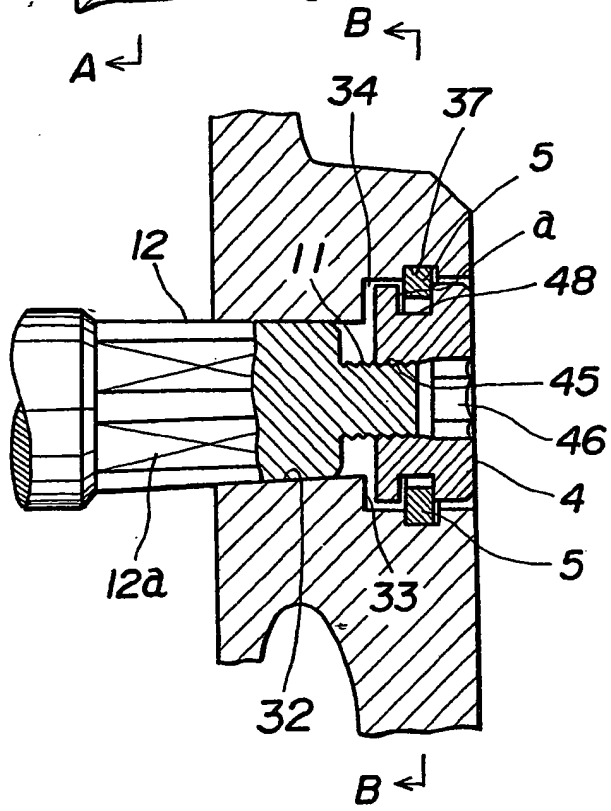
12a
33
3
A

Fig. 8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12
11
48
45
46
4
5
12a
33
32
B

Fig. 9

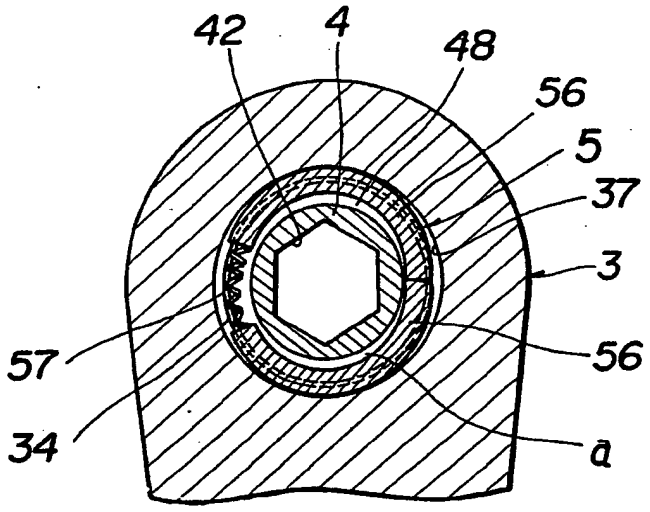
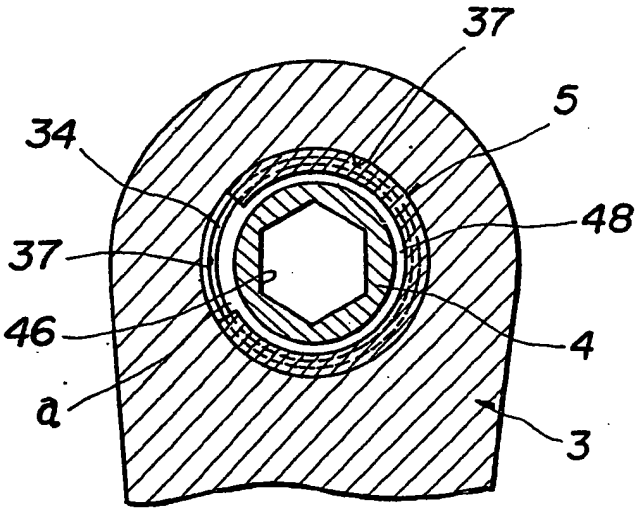


Fig. 10



SPECIFICATION

A CRANK ASSEMBLY FOR A CYCLE

The invention relates to a crank assembly for a cycle, this crank assembly comprising a crank shaft and two crank arms fixed to the axial ends of the crank shaft.

In one conventional type of crank assembly for a cycle, both axial ends of the crank shaft are provided with axially outwardly tapering engagement sections, the engagement sections bearing either internal or external threads, and each crank arm has a boss having an aperture therethrough, said aperture being capable of accommodating one of the engagement sections of the crank shaft. Unfortunately, in use the engagement sections tend to become wedged very firmly within the apertures in the crank arms, making it very difficult to remove the crank arms from the crank shaft.

To permit removal of the crank arms, each of the apertures in the crank arms is conventionally provided at its axially-outward end with an internally-threaded section, which is normally closed with a threaded bolt. To remove either crank arm from the crank shaft, its bolt is removed with a conventional spanner and a special tool is then abutted against the axial end face of the crank shaft and engaged with the screw thread in the aperture. By using the special tool, the crank arm can now be removed from the crank shaft. The provision of the necessary special tool with the crank assembly considerably increases the cost thereof and even with the special tool removal of the crank arms tends to be difficult and to require much labour.

The present invention seeks to provide a crank assembly which does not require a special tool to effect removal of the crank arms from the crank shaft, and which permits easy and quick removal of the crank arms.

Accordingly, the invention provides a crank assembly for a cycle, the assembly comprising:

a crank shaft having at either axial end thereof an engagement section of reduced cross-section, each of the engagement sections being provided with a screw thread;

two crank arms, one fixed to each axial end of the crank shaft, each crank arm having a boss through which passes an aperture, said aperture having a first section, substantially corresponding in shape to and accommodating the engagement section at that end of the crank shaft, and a second section, communicating with the first section, having a larger cross-section than the part of the first section adjacent thereto and emerging through the axially-outward face of the boss, a shoulder existing between the said first and second sections of the aperture;

two retaining members, one associated with each crank arm, each retaining member having a screw thread engaged with the screw thread on one of the engagement sections of the crank shaft so that the retaining member co-acts with the shoulder of its associated crank arm, thereby preventing axial movement of that crank arm relative to the crank shaft; and

two locking members, one associated with each crank arm, each locking member being engaged with its associated crank arm and thereby retained in a fixed axial position relative to the boss of that crank arm, each locking member entering into the second section of the aperture in its associated crank arm so as to restrict axial movement of the said retaining member relative to the associated crank arm.

In saying that each retaining member of the crank assembly of the invention co-acts with the shoulder of its associated crank arm we do not exclude the possibility that washers, spacers or other integers may be interposed between the co-acting parts so long as effective co-action is still achieved therebetween.

Very desirably, in the crank assembly of the invention, each engagement section of the crank shaft and the first section of the aperture in each crank arm are of non-circular cross-section. Preferably, each engagement section of the crank shaft and the first section of the aperture in each crank arm is tapered outwardly from the centre of the crank shaft.

In one preferred form of the crank assembly of the invention, each engagement section is provided with an axial bore, the screw thread of each engagement section is an internal thread within its axial bore, and each retaining member has the form of a screw threaded bolt having its threaded shank engaged with the screw thread in the bore of the adjacent engagement section and its head co-acting with the shoulder of its associated crank arm. Alternatively, the axially-outward end of each engagement portion may be provided with an external screw thread and each retaining member have the form of a nut engaged with the external screw thread of the adjacent engagement section and co-acting with the shoulder of its associated crank arm.

Desirably, at least the axially-inward end of the second section of the aperture in each crank arm is cylindrical and is screw-threaded, and at least the axially-inward end of each locking member is cylindrical and bears an external screw thread engaged with the said screw thread in the second section of the aperture in the associated crank arm. Alternatively, a part of the external surface of each retaining member disposed within the second section of the aperture in the associated crank arm and the surface of the crank arm encircling the said second section may each be provided with at least one groove, each locking member co-acting with the grooves in its associated crank arm and retaining member. In the latter case, preferably each of the said grooves extends completely around the retaining member or second section and each locking member comprises a pair of half-rings, each of which has substantially the form of half an annular lamina, and a spring urging the half-rings radially outwardly, or comprises an elastically-deformable, substantially C-shaped

ring. Finally, where the retaining member and crank arm are provided with the aforesaid grooves, each locking member may comprise a spring engaged with the groove(s) on one of the associated retaining member and crank arm and at least one member urged by the spring radially into engagement with the groove(s) on the other of the associated retaining member and crank arm.

Preferred embodiments of the invention will now be described, though by way of illustration only, with reference to the accompanying drawings, in which:

Figure 1 is a front elevation, partly in section, of a first crank assembly of the invention;

Figure 2 is a part side elevation of the crank assembly shown in Figure 1 looking from the right of that Figure;

Figure 3 is an exploded view, partly in section, of part of the crank assembly shown in Figures 1 and 2;

Figure 4 is a perspective view of one of the locking members of the crank assembly shown in Figures 1 to 3;

Figure 5 is a front elevation, partly in section, of a second crank assembly of the invention;

Figure 6 is a part side elevation of the crank assembly shown in Figure 5 looking from the right of that Figure;

Figures 7 and 8 are sections through parts of third and fourth crank assemblies of the invention; and

Figures 9 and 10 are sections along the lines A—A and B—B in Figures 7 and 8 respectively.

The first crank assembly of the invention, shown in Figures 1 to 4 of the accompanying drawings, is intended for use on a conventional cycle and comprises a crank shaft 1, crank arms 2 and 3, one fixed to each axial end of the crank shaft 1, two retaining members 4, one associated with each crank arm, and two locking members, one associated with each crank arm. The crank shaft 11 has at either axial end thereof an outwardly tapered engagement section 12 of reduced, non-circular cross-section provided with flat faces 12*a*. Each engagement section 12 is provided with an axial bore having an internal screw thread 11. The central section of the crank shaft 1 between the engagement sections 12 is provided with ball races 13 and 14 and two sets of ball bearings 10 are held between the ball races 13 and 14 and two further ball races 81 and 91 respectively on end cups 8 and 9 respectively. A housing 7 is screw threadedly engaged with the cups 8 and 9 and thus the ball bearings 10 render the crank shaft 1 freely rotatable within the housing 7.

The crank arms 2 and 3 each possess a boss 21 or 31 through which passes an aperture, this aperture having a first section 22 or 32, substantially corresponding in shape to and accommodating the engagement section 12 at that end of the crank shaft 1 (the flat planes within the first sections 22 and 32, corresponding to and engaging the flat faces 12*a* on the engagement sections 12, are designated 22*a* and 32*a* respectively), and a second section 24 or 34 communicating with the first section 22 or 32, having a cross-section larger than the part of the first section 22 or 32 adjacent thereto (and indeed, in this embodiment, larger than any part of the first section), emerging through the axially-outward face of the boss 21 or 31 and provided with an internal thread 25 or 35: a shoulder 23 or 33 is provided between the first and second sections of each aperture and a washer 6 is disposed adjacent this shoulder. The crank arm 3 is also provided with a plurality of supporting arms 36 extending radially-outwardly from its boss 31 and two sprockets 15 and 16 differing in diameter are secured to the radially-outward ends of the arms 36 by bolts 17 and 18 respectively. The radially-outward end of each crank arm carries a conventional pedal (not shown).

Each retaining member has the form of a screw-threaded bolt having on its shank a thread 44 engaged with the screw thread 11 in the bore of the adjacent engagement section 12 of the crank shaft and a head 41 provided with a hexagonal recess 42 (see especially Figures 2 and 3) and a radially-outwardly extending flange 43 lying between shoulders *a* and *b* and disposed within the second section 24 or 34 of the aperture. The shank of each retaining member 4 is screwed into the bore in the adjacent engagement section until the shoulder *b* presses against the washer 6, so that the flange 43 on the retaining member 4 co-acts, via the washer 6, with the shoulder 23 or 33 on the crank arm 2 or 3, thereby preventing axial movement of the crank arm relative to the crank shaft 1.

Hereinafter, only the right-hand locking member 5 shown in Figure 1 will be described, the left-hand locking member 5 being identical in form and use. The said right-hand locking member 5 has, as best seen in Figures 3 and 4, substantially the form of a hollow cylinder provided with an external screw thread 51. The internal aperture passing through the locking member has three sections, namely a first, cylindrical section 53 which is larger in diameter than the flange 43 on the adjacent retaining member 4 and has a length slightly greater than the axial length of that flange, a second, cylindrical section 52, which is smaller in diameter than the flange 43 but larger in diameter than the remainder of the head 41, and a third section 54 which has a cylindrical portion 54*a* larger in diameter than the recess 42 in the retaining member and two radially-outwardly extending portions 54*b* (see especially Figure 2).

The external thread 51 on the locking member 5 is engaged with the internal thread 35 in the second section 34 of the aperture in the crank arm 3, the locking member being screwed into the section 34 until it assumes and is retained in a fixed axial position relative to the boss 31 of the crank arm 3, in which position the locking member 5 enters into the second section 34 until its left-hand axial end in Figures 1 and 3 abuts the washer 6, the first section 51 of the aperture in the locking member accommodates the flange 43, a small clearance is left between the shoulder *a* and the shoulder between the sections 53 and 52, and the section 52 accommodates the head 41 of the

retaining member. Rotation of the locking member 5 to alter its position within the second section 34 of the aperture may be effected by placing a coin or other flat member within the portions 54*b* and twisting the coin or flat member, no special tool being required.

When the locking member 5 is in its aforesaid fixed axial position relative to the boss 31, axial movement of the retaining member 4 relative to its associated crank arm 3 is restricted to the extent of the aforesaid clearance, and rotation of the retaining member relative to the crank arm 3 is restricted to that which will cause it to move axially through the aforementioned clearance.

To remove the crank arm 3 from the crank shaft 1, an Allen key or other suitably shaped tool is pushed into the recess 42 in the retaining member 4 and then turned so that the retaining member 4 moves to the right in Figures 1 and 3. After a limited rotation of the retaining member 4, the shoulder *a* therein abuts against the shoulder between the sections 53 and 52 of the aperture in the locking member 5. Further rotation of the retaining member 4 then causes axial thrust to be transmitted from the retaining member 4 via the locking member 5 to the crank arm 3, thereby causing the crank arm 3 to be moved axially outwardly from the crank shaft 1. Thus, the crank arm 3 can be easily and quickly removed from the crank shaft 1 without the use of any special tool. The other crank arm 2 can of course be removed from the crank shaft 1 in a precisely similar manner.

The portions 54*b* of the aperture in each locking member 5 may be replaced by differently-shaped recesses in the portion 54*a* thereof, or by projections extending into the section 54*a*, or by recesses or projections adjacent the outer cylindrical surface of the locking member. Similarly, the head 41 of each retaining member 4 may have a recess 42 of a different shape, or the recess 42 may be replaced by a projection, or the head itself may be made polygonal in cross section, so long as the form of the head permits proper rotation of the retaining member.

The second crank assembly of the invention shown in Figures 5 and 6 of the accompanying drawings differs from that shown in Figures 1 to 4 thereof in that the engagement portions 12 of its crank shaft 1 lack the threaded axial bores. Instead, the axially-outward end of each engagement section is provided with an external screw thread 11 and each retaining member has the form of a nut having an internal thread 45 engaged with the external screw thread of the adjacent engagement section, the nut co-acting with the shoulder 22 or 33 of its associated crank arm 2 or 3 respectively via an outwardly extending flange 47. Hereinafter only the retaining and locking members associated with the right-hand crank arm 3 in Figure 5 will be described, but the corresponding members associated with the other crank arm 2 are exactly the same in form and use.

The axially-outward face of the retaining member 4 associated with the crank arm 3 has a hexagonal recess 42 which is a continuation of the threaded bore in the retaining member. The adjacent locking member 5 differs from those used in the first crank assembly of the invention shown in Figures 1 to 4 of the accompanying drawings in that the aperture therethrough is of constant diameter, in that the portions 54*b* of said aperture are replaced by two cylindrical recesses 54, and in that it bears a radially-outwardly extending flange 55 which, when the locking member is in its axial position shown in Figures 5 and 6, abuts the axially-outward surface of the crank arm 3. With the locking member in this position, a small clearance exists between the shoulder *a* on the axially-outward side of the flange 47 and the axially-inward end of the locking member.

Screwing of the locking member 5 into the second section 34 of the aperture in the crank arm 3 is effected using a conventional cycle tool having two spaced spigots. Removal of either crank arm 2 or 3 from the crank shaft 1 in the second crank assembly of the invention is effected in a precisely similar manner to that employed in the first crank assembly described above.

The third and fourth crank assemblies of the invention, parts of which are shown in Figures 7 and 9 and Figures 8 and 10 respectively of the accompanying drawings, differ from the first and second crank assemblies described above in that their retaining members 4 do not possess a radially-outwardly extending flange 43 or 47. Instead a part of the external surface of each retaining member disposed within the second section 34 of the aperture in the associated crank arm and the surface of the said crank arm encircling the said second section 34 are each provided with a groove 37 or 48 respectively, and each locking member 5 co-acts with the grooves in its associated crank arm and retaining member. Furthermore, the diameter of the heads 41 of the bolts used as the retaining members 4 in the third crank assembly of the invention (see Figure 7) and of the nuts used as the retaining members 4 in the fourth crank assembly of the invention (see Figure 8) are made sufficiently large that they can co-act with the shoulder 23 or 33 on the associated crank arm without requiring the presence of a radially-outwardly extending flange.

In both the third and fourth crank assemblies of the invention, each of said grooves extends completely around the retaining member or second section of the aperture in the crank arm. In the third crank assembly, each locking member comprises (as best seen in Figure 9) a pair of half-rings 56, each of which has substantially the form of half an annular lamina, and a spring 57 urging the half-rings radially outwardly, whilst in the fourth crank assembly, each locking member comprises (as best seen in Figure 10) an elastically-deformable C-shaped ring. In both cases, the locking members can be contracted radially to enable it to be forced wholly within the groove 48 in the retaining member 4 so that the retaining member can be screwed into place, whereupon the ring expands radially and enters the groove 37.

The crank arms of the third and fourth crank assemblies of the invention may be detached from the crank shaft thereof in a manner precisely similar to that used for detaching the crank arms of the first crank assembly, as described above.

Where the retaining members and the crank arms are provided with grooves a third possible form of locking member comprises a spring engaged with the groove(s) on one of the associated retaining member and crank arm and at least one member urged by the spring radially into engagement with the groove(s) on the other of the associated retaining member and crank arm. In this case, the grooves do not need to extend completely around the retaining member or the aperture in the crank arm.

It will be seen that the preferred crank assemblies of the invention described above allow their crank arms to be removed easily and quickly from their crank shafts without the use of any special tools simply by unscrewing the retaining members.

CLAIMS

1. A crank assembly for a cycle, the assembly comprising:—

a crank shaft having at either axial end thereof an engagement section of reduced cross-section, each of the engagement sections being provided with a screw thread;

two crank arms, one fixed to each axial end of the crank shaft, each crank arm having a boss through which passes an aperture, said aperture having a first section, substantially corresponding in shape to and accommodating the engagement section at that end of the crank shaft, and a second section, communicating with the first section, having a larger cross-section than the part of the first section adjacent thereto and emerging through the axially-outward face of the boss, a shoulder existing between the said first and second sections of the aperture;

two retaining members, one associated with each crank arm, each retaining member having a screw thread engaged with the screw thread on one of the engagement sections if the crank shaft so that the retaining member co-acts with the shoulder of its associated crank arm, thereby preventing axial movement of that crank arm relative to the crank shaft; and

two locking members, one associated with each crank arm, each locking member being engaged with its associated crank arm and thereby retained in a fixed axial position relative to the boss of that crank arm, each locking member entering into the second section of the aperture in its associated crank arm so as to restrict axial movement of the said retaining member relative to the associated crank arm.

2. A crank assembly as claimed in Claim 1, in which each engagement section of the crank shaft and the first section of the aperture in each crank arm are of non-circular cross-section.

3. A crank assembly as claimed in Claim 1 or 2, in which each engagement section of the crank shaft and the first section of the aperture in each crank arm is tapered outwardly from the centre of the crank shaft.

4. A crank assembly as claimed in any of the preceding claims, in which each engagement section is provided with an axial bore, the screw thread of each engagement section is an internal thread within its axial bore, and each retaining member has the form of a screw threaded bolt having its threaded shank engaged with the screw thread in the bore of the adjacent engagement section and its head co-acting with the shoulder of its associated crank arm.

5. A crank assembly as claimed in any of Claims 1 to 3, in which the axially-outward end of each engagement section is provided with an external screw thread and each retaining member has the form of a nut engaged with the external screw thread of the adjacent engagement section and co-acting with the shoulder of its associated crank arm.

6. A crank assembly as claimed in any of the preceding claims, in which each retaining member is provided with a radially-outwardly-extending flange disposed within the second section of the aperture in the associated crank arm, and in which each locking member can co-act with the flange of the associated retaining member.

7. A crank assembly as claimed in any of the preceding claims, in which at least the axially-inward end of the second section of the aperture in each crank arm is cylindrical and is screw-threaded, and at least the axially-inward end of each locking member is cylindrical and bears an external screw thread engaged with the said screw thread in the second section of the aperture in the associated crank arm.

8. A crank assembly as claimed in any of Claims 1 to 6, in which a part of the external surface of each retaining member disposed within the second section of the aperture in the associated crank arm and the surface of the crank arm encircling the said second section are each provided with at least one groove, each locking member co-acting with the grooves in its associated crank arm and retaining member.

9. A crank assembly as claimed in Claim 8, in which each of the said grooves extends completely around the retaining member or second section, and each locking member comprises a pair of half-rings, each of which has substantially the form of half an annular lamina, and a spring urging the half-rings radially outwardly.

10. A crank assembly as claimed in Claim 8, in which each of the said grooves extends completely around the retaining member or second section, and each locking member comprises an elastically-deformable, substantially C-shaped ring.

11. A crank assembly as claimed in Claim 8, in which each locking member comprises a spring engaged with the groove(s) on one of the associated retaining member and crank arm and at least one member urged by the spring radially into engagement with the groove(s) on the other of the associated retaining member and crank arm.

12. A crank assembly as claimed in Claim 1 and substantially as herein described, with reference to and as illustrated in Figures 1 to 4, Figures 5 and 6, Figures 7 and 9 in Figures 8 and 10 of the accompanying drawings.

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